

# A new subspecies of the mantis *Hierodula patellifera* (Mantodea: Mantidae) from the Daito Islands, the Ryukyus, Japan

KAZUYUKI OSHIMA<sup>1</sup>

<sup>1</sup> Laboratory of Entomology, Faculty of Agriculture, Tokyo University of Agriculture, Atsugi, Kanagawa, Japan.

Corresponding author: Kazuyuki Oshima (hexapoda0364@gmail.com)

Academic editor: Matan Shelomi | Received 14 December 2020 | Accepted 8 February 2021 | Published 3 June 2021

<http://zoobank.org/D3AA126A-4AF7-4DAA-8EEA-59B45A6817A5>

Citation: Oshima K (2021) A new subspecies of the mantis *Hierodula patellifera* (Mantodea: Mantidae) from the Daito Islands, the Ryukyus, Japan. Journal of Orthoptera Research 30(1): 95–98. <https://doi.org/10.3897/jor.30.62022>

## Abstract

A new subspecies of the Asian mantis *Hierodula patellifera* (Audinet-Serville, 1839), *Hierodula patellifera daitoana* **ssp. nov.**, is described based on specimens collected from the Daito Islands, the Ryukyus, Japan. This new subspecies is distinguished from the nominotypical subspecies *H. patellifera patellifera* in adulthood by the relatively larger body size, the larger number of antennal segments, the presence of a white marking along the dorsal-inner surface on the procoxa, and marginal spines of the procoxa comprising two large and several small tooth-like projections.

## Keywords

Dictyoptera, Kita-daito-jima Island, Minami-daito-jima Island, nymph, Okinawa, taxonomy

## Introduction

The mantis species *Hierodula patellifera* (Audinet-Serville, 1839) (Mantodea: Mantidae) is widely distributed in the Oriental and eastern Palearctic regions, including India, Nepal, China, Taiwan, Korea, Japan, Vietnam, Thailand, Malaysia, Singapore, New Guinea, Java, Sumba, the Philippines, Italy, France, and Hawaii (Fig. 1; Ehrmann 2002, Leong 2009, Ehrmann and Borer 2015, Patel and Singh 2016, Mukherjee et al. 2017, Battiston et al. 2019, Moulin 2020). In Japan, it is distributed in Honshu, Shikoku, Kyushu, and the Ryukyus (Nakamine 2016, Oshima et al. 2020). It is readily distinguished from other members of the genus by the marginal spines of the procoxa, which are two to five in number, white or yellow, well defined, and tear drop shaped (Leong 2009, Zhu et al. 2012, Chatterjee and Srinivasan 2013, Majumder et al. 2015, Shcherbakov and Anisyutkin 2018). In this species, a single subspecies, *H. patellifera manillana* Giglio-Tos, 1912, was formerly recognized as part of the Philippine population by Giglio-Tos (1912) and Beier (1935), although no justification for this designation was provided. However, this subspecies has been considered a synonym of *H. patellifera* by Ehrmann (2002) and subsequent authors (Nakamine 2016, Otte et al. 2020). At present, *H. patellifera* has no infraspecific taxa.

The Daito Islands consist of five oceanic islands located in the Philippine Sea southeast of the main island of Okinawa, Japan. Among these islands, those of Kita-daito-jima and Minami-daito-jima, which are populated by humans, lie approximately 360 km from the nearest neighboring island, Okinawa-jima, and provide a unique isolated ecosystem populated by several endemic species (Shimizu 2003).

During an investigation of the mantis fauna of the Daito Islands between 2015 and 2018, I collected several individuals of an indeterminate *Hierodula* species from both Kita-daito-jima Island and Minami-daito-jima Island. Detailed observations of the male genitalia indicated that these individuals were clearly specimens of *H. patellifera* (Fig. 2); however, other morphological characters, including the relative length of the body, number of antennal segments, coloration of the procoxae, and shape of the marginal spines, were distinctly different from those of other populations of the species. Eventually, I considered the possibility that the Daito Islands population is a distinct subspecies.

In the present paper, I describe this putative subspecies of *H. patellifera* from the Daito Islands, for which the name *Hierodula patellifera daitoana* **ssp. nov.** is proposed.

## Materials and methods

*Hierodula patellifera daitoana* **ssp. nov.** was occasionally collected by K. Oshima between 2015 and 2018. Day and night surveys involving opportunistic collections were conducted on Minami-daito-jima Island from February 17 to 20, 2015 and May 14 to 17, 2016, and on Kita-daito-jima Island from September 24 to 26, 2016 and June 24 to 28, 2018. Individuals that were nymphs at the time of collection were reared to adulthood and then dried for morphological observations. The specimens were examined under a stereoscopic microscope (SZ60; Olympus, Tokyo, Japan), and photographs were taken using a digital camera (EOS8000D; Canon, Tokyo, Japan). Measurements of body length (from the anterior margin of the pronotum to the apex of the wing) were taken using a ruler. Observations and photographs were based on both fresh and dried specimens. The type specimens have been deposited in the Laboratory of Entomology, Tokyo University of Agriculture, Atsugi, Japan (LETUA).

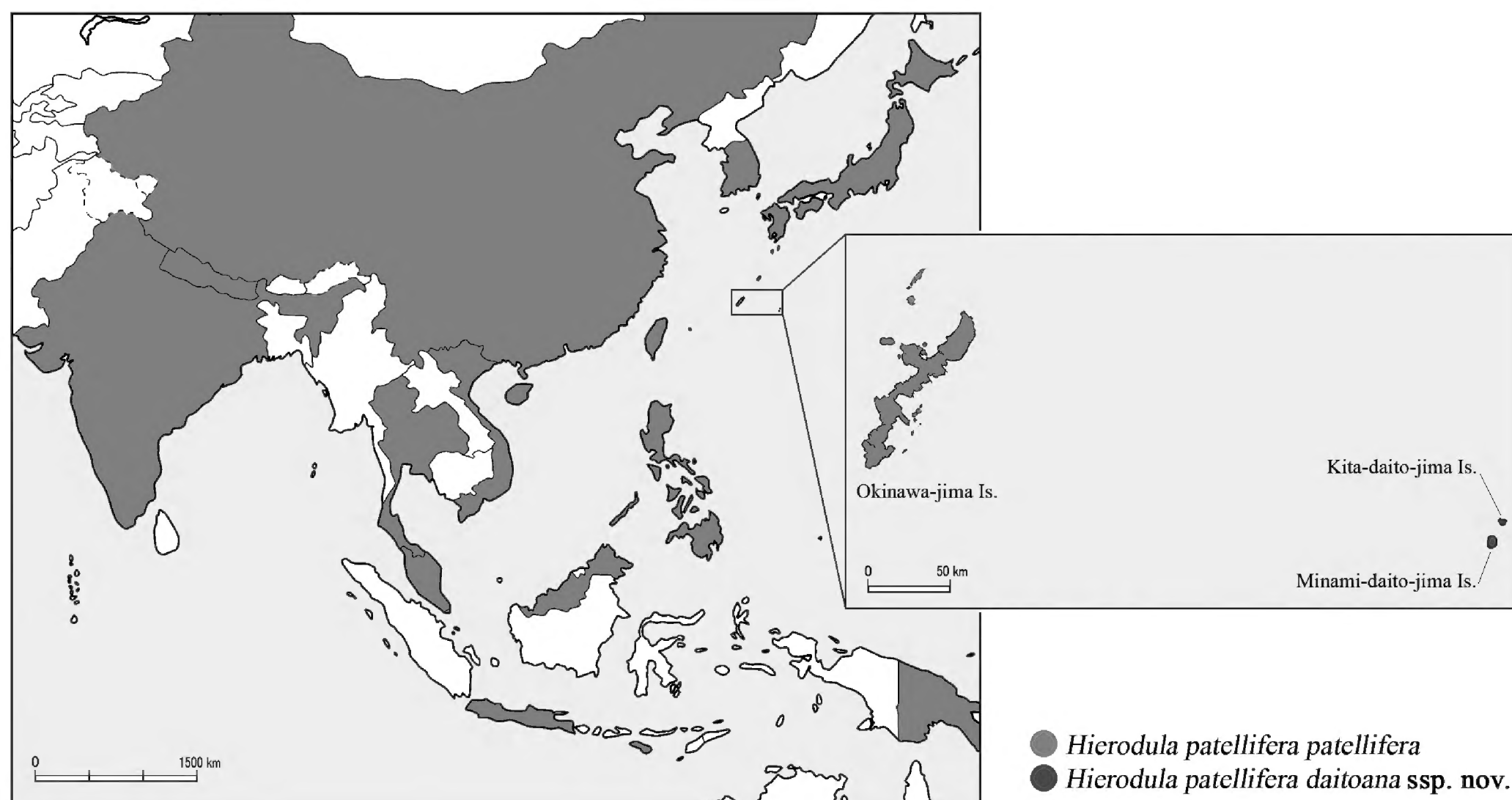


Fig. 1. Total known distribution of *Hierodula patellifera* in Asia.

## Results

### Taxonomy

Family Mantidae Latreille, 1802

Subfamily Hierodulinae Brunner de Wattenwyl, 1893

Genus *Hierodula* Burmeister, 1838

Nominal species *Hierodula membranacea* (Burmeister, 1838)

*Hierodula patellifera daitoana* ssp. nov.

<http://zoobank.org/19A70420-0A90-493A-9CE5-E8F839CFE2C3>

Figs 2–5, 7

**Type material.**—**Holotype:** JAPAN • ♂; Okinawa, Shimajiri-gun, Kita-daito-jima Is., Kita-daito-son, Minato; 25°57'16"N, 131°17'17"E; 24 Jun. 2018; K. Oshima leg.; LETUA-IC-2021-00001. **Paratypes:** JAPAN • 1♂, 2♀; (collected as nymphs); Okinawa, Shimajiri-gun, Kita-daito-jima Is., Kita-daito-son, Minato; 25°57'19"N, 131°17'16"E; 25–26 Oct. 2016; K. Oshima leg.; LETUA-IC-2021-00002–00004 • 2♂; Okinawa, Shimajiri-gun, Kita-daito-jima Is., Kita-daito-son, Minato; 25°57'16"N, 131°17'17"E; 24–25 Jun. 2018; K. Oshima leg.; LETUA-IC-2021-00005–00006 • 2♂, 2♀ (collected as nymphs); Okinawa, Shimajiri-gun, Kita-daito-jima Is., Kita-daito-son, Minato; 25°57'19"N, 131°17'16"E; 24–26 Jun. 2018; K. Oshima leg.; LETUA-IC-2021-00007–00010 • 1♂ (collected as nymph); Okinawa, Shimajiri-gun, Minami-daito-jima Is., Minami-daito-son, Kita; 25°51'59"N, 131°14'50"E; 17 Feb. 2015; K. Oshima leg.; LETUA-IC-2021-00011 • 1♀ (collected as nymph); Okinawa, Shimajiri-gun, Minami-daito-jima Is., Minami-daito-son, Kita; 25°51'58"N, 131°14'50"E; 16 Apr. 2016; K. Oshima leg.; LETUA-IC-2021-00012 • 1♀ (collected as nymph); Okinawa, Shimajiri-gun, Minami-daito-jima Is., Minami-daito-son, Ikenosawa; 25°49'12"N, 131°13'18"E; 17 Apr. 2016; K. Oshima leg.; LETUA-IC-2021-00013.

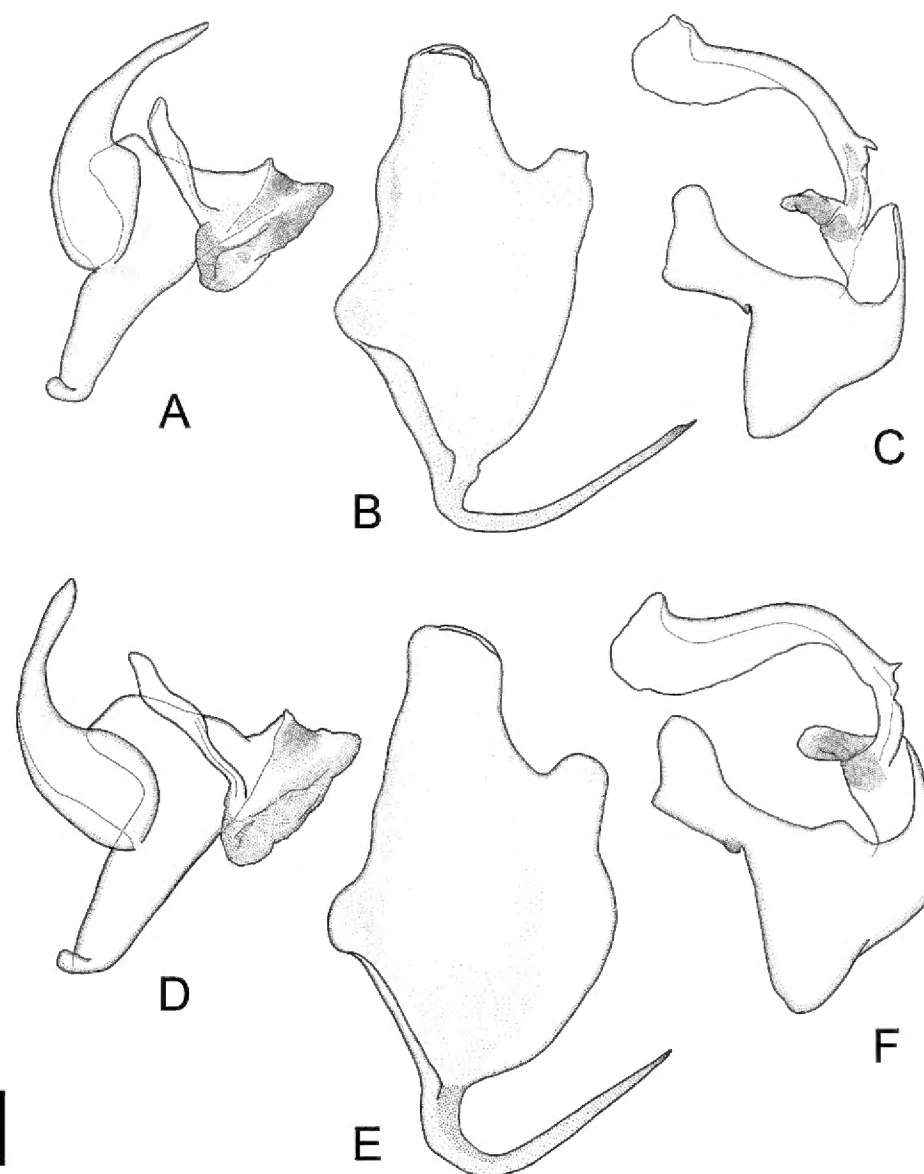


Fig. 2. Disarticulated genital complex (to isolate the individual phallomeres) of *Hierodula patellifera*, male, dorsal view: A–C. *Hierodula patellifera patellifera* from Okinawa-jima Is.; D–F. *Hierodula patellifera daitoana* ssp. nov., from Kita-daito-jima Is. (holotype); A, D. Left phallomere; B, E. Ventral phallomere; C, F. Right phallomere. Scale bar: 1 mm.





Fig. 3. *Hierodula patellifera daitoana* ssp. nov., male, holotype. Habitus, dorsal view. Scale bar: 10 mm.

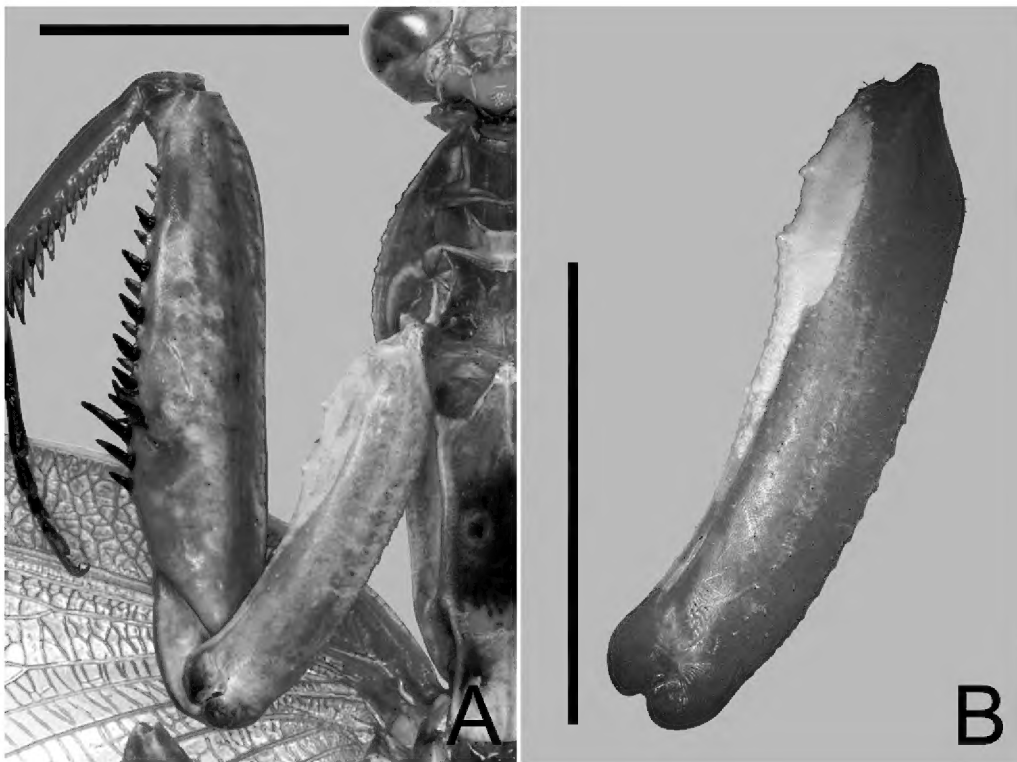


Fig. 4. Procoxa of *Hierodula patellifera daitoana* ssp. nov., lateral view: A. Male, holotype; B. Female, paratype, before discoloration. Scale bars: 10 mm.

**Subspecies characters.**—Adult: Differs from the nominotypical subspecies *H. patellifera patellifera* by having the following characters: Body length 64–77 mm in males, 69–79 mm in females; antenna at most 115-segmented in both sexes; procoxa (Fig. 4A, B) with a large white marking along dorsal-inner surface (white marking

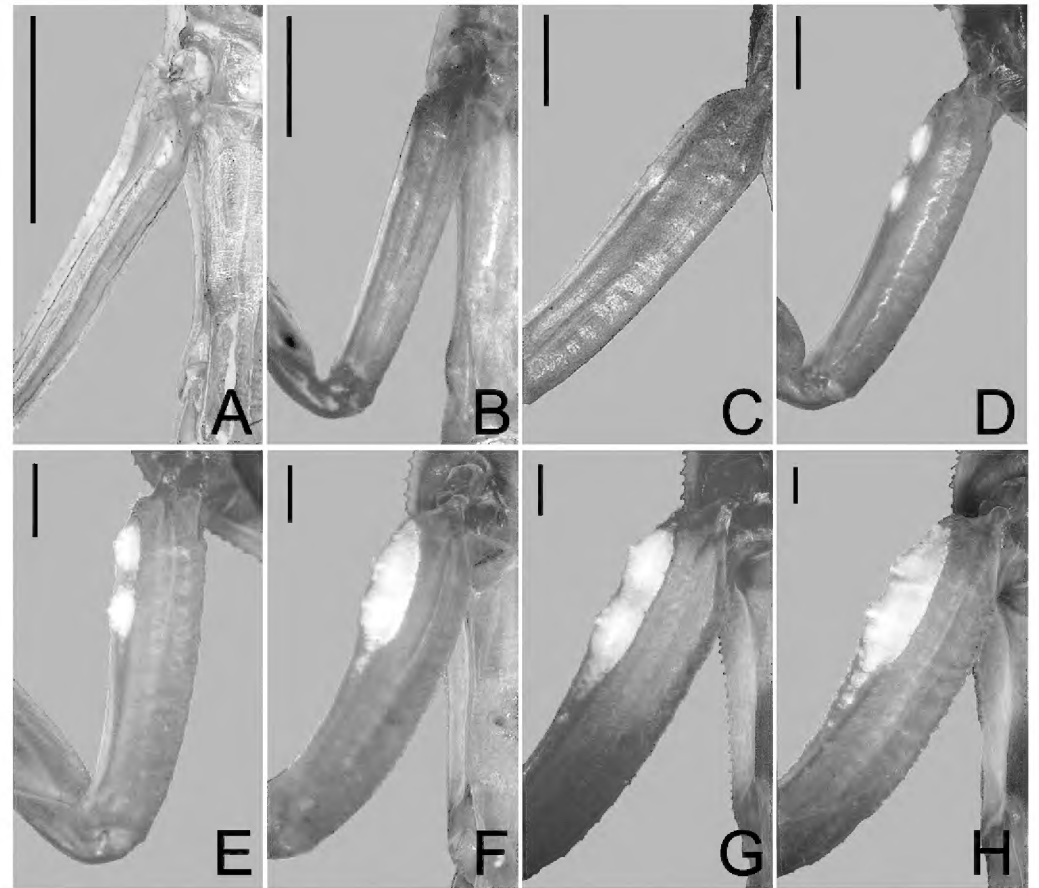


Fig. 5. Procoxa in nymphal stages of *Hierodula patellifera daitoana* ssp. nov., male, lateral view: A. 1<sup>st</sup> instar; B. 2<sup>nd</sup> instar; C. 3<sup>rd</sup> instar; D. 4<sup>th</sup> instar; E. 5<sup>th</sup> instar; F. 6<sup>th</sup> instar; G. 7<sup>th</sup> (penultimate) instar; H. 8<sup>th</sup> (last) instar. Scale bars: 1 mm.



Fig. 6. Habitats of *Hierodula patellifera daitoana* ssp. nov. on Kita-daito-jima Island.

may become unclear in dry specimens), and with 2 large and several small tooth-like marginal spines (not well-defined). Nymph: Procoxa of 1<sup>st</sup>- and 2<sup>nd</sup>-instars (Fig. 5A, B) lacking white markings and marginal spines; procoxa of 3<sup>rd</sup> instar (Fig. 5C) with or without a small white marking, and with slightly developed, tooth-like marginal spines; procoxa of 4<sup>th</sup> instar (Fig. 5D) with 2 small, white markings and with slightly developed, tooth-like marginal spines; procoxa of 5<sup>th</sup> instar (Fig. 5E) with 2 medium-sized, irregular, white markings and with 2 large (somewhat developed) and several small tooth-like marginal spines; procoxa of 6<sup>th</sup>- to last-instars (Fig. 5F–H) with a large-sized and irregular white marking and with 2 large (well developed) and several small tooth-like marginal spines.

**Distribution.**—Kita-daito-jima Is. and Minami-daito-jima Is., the Ryukyus, Japan.

**Etymology.**—This subspecific name is named after the Daito Islands, the type locality of the subspecies; an adjective.



Fig. 7. A *Hierodula patellifera daitoana* ssp. nov. female and ootheca immediately after oviposition.

**Ecology.**—During my surveys, adults and nymphs appeared from May to July and in all seasons, respectively. Both adults and nymphs were found in grassland adjacent to a sugarcane field (Fig. 6) and forest edges, particularly on the bushy tree *Acalypha wilkesiana* Müll. Arg. (Euphorbiaceae). Some specimens were also found in a residential area. Oothecae were laid on twigs and trunks as well as on artificial objects (Fig. 7).

### Acknowledgements

I express my cordial thanks to Kazuhisa Yamasaki (the University of Tokyo) for his constructive suggestions. I would also like to thank Yoshinobu Kusumoto (Western Region Agricultural Research Center, NARO) and Koichi Tanaka (Tokyo University of Agriculture) for assistance regarding the identification of plant species, the members of our laboratory for kindly offering materi-

als and supporting my field investigations, and Tadashi Ishikawa (Tokyo University of Agriculture) for his critical reading of the manuscript and valuable comments.

### References

- Battiston R, Leandri F, di Pietro W, Andria S (2019) *Mantis, Hierodula e Sphodromantis*: aggiornamento su conoscenze e identificazione delle mantidi (Mantodea: Mantidae) native ed aliene presenti in Italia. *Pianura—Scienze e storia dell'ambiente padano* 38: 86–96. [In Italian]
- Beier M (1935) Mantodea. Subfamilie: Mantidae. In: Wytsman P (Ed.) *Genera Insectorum*, Fascicule 203: 1–146.
- Chatterjee P, Srinivasan G (2013) Morphological variation in *Hierodula patellifera* Serville, 1839 from India. *Prommalia* 1: 131–135.
- Ehrmann R (2002) MANTODEA Gottesanbeterinnen der Welt. *Natur und Tier*, Münster, 519 pp. [In German]
- Ehrmann R, Borer M (2015) Mantodea (Insecta) of Nepal: an annotated checklist. In: Hartmann, Weipert (Eds) *Biodiversität und Naturlandschaft im Himalaya*. V. Naturkundemuseum, Erfurt, 227–274.
- Giglio-Tos E (1912) Mantidi esotici. V. Mantes, Tenoderæ, Hierodulæ et Rhomboderæ. *Bollettino della Società Entomologica Italiana* 43: 3–167. [In Italian]
- Leong TM (2009) Oviposition and hatching in the praying mantis, *Hierodula patellifera* (Serville) in Singapore (Mantodea: Mantidae: Paramantidae). *Nature in Singapore* 2: 55–61.
- Majumder A, Raha A, Mukherjee TK, Chandra K, Srinivasan G (2015) Mantis (Insecta: Mantodea) fauna of Chhattisgarh, India. *Records of the Zoological Survey of India* 115: 365–383.
- Moulin N (2020) When Citizen Science highlights alien invasive species in France: the case of Indochina mantis, *Hierodula patellifera* (Insecta, Mantodea, Mantidae). *Biodiversity Data Journal* 8: 1–10. <https://doi.org/10.3897/BDJ.8.e46989>
- Mukherjee TK, Chakraborti U, Roy S, Biswas O, Das SK, Samanta J, Mitra B (2017) First report of the order Mantodea from Sundarban biosphere reserve, India. *Journal on New Biological Reports* 6: 117–121.
- Nakamine H (2016) Mantodea. In: *Orthopterological Society of Japan (Ed.) The Standard of Polyneoptera in Japan*. Gakken Plus, Tokyo, 198–205. [In Japanese with English title]
- Oshima K, Hayashi K, Terai J, Kudo S (2020) Records of six species of Mantodea from the Miyako Islands, the Ryukyus, Japan, including those found in UV-LED light traps. *Fauna Ryukyana* 57: 1–11. [In Japanese with English title and abstract]
- Otte D, Spearman L, Stiewe MBD (2020) Mantodea Species File. Version 5.0/5.0. [2020/12/1]. <http://www.mantodea.speciesfile.org>
- Patel S, Singh R (2016) Updated checklist and distribution of Mantidae (Mantodea: Insecta) of the world. *International Journal of Research Studies in Zoology* 2: 17–54. <https://doi.org/10.20431/2454-941X.0204003>
- Shcherbakov E, Anisyutkin L (2018) Update on the praying mantises (Insecta: Mantodea) of South-East Vietnam. *Annales de la Société entomologique de France (Nouvelle Série)* 54: 119–140. <https://doi.org/10.1080/00379271.2018.1447394>
- Shimizu Y (2003) Nature of Minami-daito-jima Island—From the point of view other oceanic island— *Studies in Regional Science* 16: 9–32. [In Japanese]
- Zhu X, Wu C, Yuan Q (2012) Mantodea in China. Xiyuan Publishing House, Beijing, 331 pp. [In Chinese]